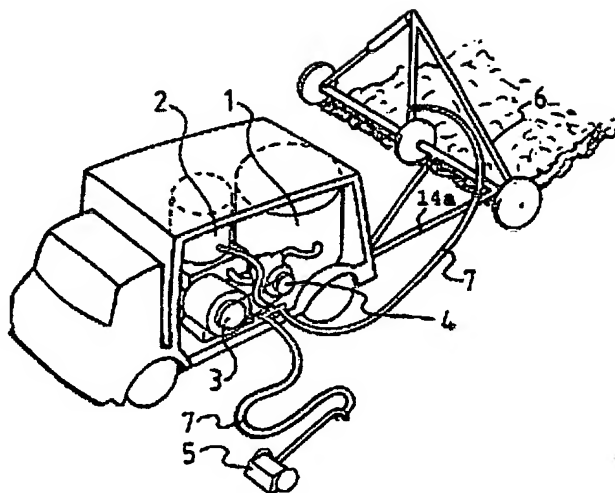


APPLICATION OF HEAT TO CONTROL VEGETATION**Patent number:** WO0207513**Publication date:** 2002-01-31**Inventor:** TINDALL DENNIS WALTER (NZ); JAMES GIBB
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INTERNAT LTD (NZ)**Classification:****- international:** A01M21/04; A01M7/00; E01H11/00**- european:** A01M21/04; E01H11/00**Application number:** WO2001NZ00141 20010713**Priority number(s):** NZ20000505744 20000717**Cited documents:**US5575111
WO9405429
AU661648**Abstract of WO0207513**

An apparatus for killing weeds by the application of hot foam, the apparatus mounted on a self-powered vehicle and comprising a water tank (1), a boiler (2), a pump (4) and an applicator head (5). Foaming agent is added to the water tank (1) prior to heating in the boiler (2). The hot liquid mixture, at or close to boiling point, is pumped from the boiler (2) via a liquid hose (7) to the applicator head (5). Low-pressure air is supplied by a blower via an air hose adjacent to the liquid hose (7) to the applicator head (5) so that a hot foam is created at the applicator (5). The foam is laid on the weeds as a continuous blanket at temperature over 90 DEG C.



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APPLICATION OF HEAT TO CONTROL VEGETATION

Claims of WO0207513

CLAIMS 1. A method of killing or controlling weeds, comprising applying to the weeds pressurised hot foam from an applicator, by spraying the foliage of the weeds, wherein hot foam is supplied to the applicator at a temperature at or just prior to the applicator in the range of 75 C to 100 C or even more, so that the applicator supplies enough heat in the form of hot foam to effectively kill or control weeds.

2. A method as claimed in claim 1, wherein the hot foam is produced by heating a supply of water to which a foaming agent has been added.

3. A method as claimed in claim 1, wherein the foaming agent is biodegradable.

4. A method as claimed in claim 1, wherein the foaming agent is a plant sugar extract.

5. A method as claimed in claim 1, wherein the method comprises applying to the weeds hot foam at a temperature of substantially 90 C or above.

6. A method as claimed in claim 1, wherein the hot foam is applied through an outlet positioned not more than 100 mm above the ground.

7. Apparatus for killing or controlling weeds, including heating means, a reservoir of water, a supply of foaming agent, pump means, and one or more applicators capable of applying to the weeds a pressurised hot foam from an applicator, by spraying the foliage of the weeds, wherein the heating means is capable of supplying hot foam to the applicator at a temperature at or just prior to the applicator in the range of 75 C to 100 C or even more, so that the applicator supplies enough heat in the form of hot foam to effectively kill or control weeds.

8. Apparatus for killing or controlling weeds as claimed in claim 7, wherein the applicator has an outlet and includes a chamber at or adjacent the outlet.

9. Apparatus for killing or controlling weeds as claimed in claim 7, further including a blower to supply air into the foam chamber so that air can be added to the foam just prior to delivery of the foam to weeds.

10. Apparatus for killing or controlling weeds as claimed in claim 7, wherein there is means for heating the air prior to delivery to the foam chamber.

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APPLICATION OF HEAT TO CONTROL VEGETATION

Description of **WO0207513**

APPLICATION OF HEAT TO CONTROL VEGETATION FIELD OF THE INVENTION

The invention relates to a method for killing or controlling vegetation.

Conventionally weed growth is controlled either by use of herbicide chemicals which are applied to the weeds by spraying or in the form of powder or granules which are sprinkled about the weeds, or alternatively by physically uprooting the weeds. Physically removing the weeds is time consuming and labour intensive. Herbicides can be relatively expensive, and there is increasing resistance to the use of such synthetic chemicals in the environment. Our New Zealand patent No. 240568 relates to killing or controlling vegetation by spraying near-boiling water thereon.

STATEMENT OF INVENTION

According to one aspect of the present invention there is provided a method of killing or controlling weeds, comprising applying to the weeds pressurised hot foam from an applicator, by spraying the foliage of the weeds, wherein hot foam is supplied to the applicator at a temperature at or just prior to the applicator in the range of 75 C to 100 C or even more, so that the applicator supplies enough heat in the form of hot foam to effectively kill or control weeds.

Advantageously the hot foam is produced by heating a supply of water to which a foaming agent has been added.

Conveniently the foaming agent is organic and is biodegradable and could be plant sugar extract.

Preferably the method comprises applying to the weeds hot foam at a temperature of substantially 90 C or above.

Conveniently the hot foam is applied through an outlet positioned not more than 100 mm above the ground.

In another aspect the invention provides apparatus for killing or controlling weeds, including heating means, a reservoir of water, a supply of foaming agent, pump means, and one or more applicators capable of applying to the weeds a pressurised hot foam from an applicator, by spraying the foliage of the weeds, wherein the heating means is capable of supplying hot foam to the applicator at a temperature at or just prior to the applicator in the range of 75 C to 100 C or even more, so that the applicator supplies enough heat in the form of hot foam to effectively kill or control weeds.

Preferably the applicator has an outlet and includes a chamber at or adjacent the outlet.

Preferably the apparatus also includes a blower to supply air into the foam chamber so that air can be added to the foam just prior to delivery of the foam to weeds.

Preferably there is means for heating the air prior to delivery to the foam chamber.

BRIEF DESCRIPTION OF THE DRAWINGS

Various embodiments of the invention will be further described with reference to the accompanying drawings, by way of example only and without intending to be limiting. In the drawings:

Figure 1 shows a van mounting apparatus of the invention including both a manual hand held applicator and a towed boom applicator,

Figure 2 shows a preferred form of manual hand held applicator of the invention,

Figure 3 is a three-quarter view from below of the head of the applicator of Figure 2,

Figure 4 is a view from immediately below of the head of the applicator of Figure 2,

Figure 5 is a view of the towed boom applicator from behind with parts removed, and

Figure 6 is a close up view of one outlet of the boom applicator of Figure 5.

PREFERRED EMBODIMENT

Figure 1 shows apparatus of the invention mounted to a van, within the van are mounted a water tank 1, which contains water and a foaming agent in predetermined ratio, a boiler 2 arranged to heat smaller volumes of water mixture supplied by the water tank 1 to the desired temperature, a pump 4, and a pump motor 3. The boiler 2 and pump motor 3 are powered from the battery of the van, or alternatively a separate generator with its own prime mover such as a small petrol motor could also be provided within the van to generate power for the pump motor and boiler.

The pump 4 supplies hot water mixture heated by the boiler 2 to the hand held applicator 5 and the towed boom applicator 6 through flexible hoses 7. The hoses 7 comprise a hot water mixture hose and a low-pressure air hose bound side-by-side. Any other water heating plant could be employed. For example instead of a boiler, a water heater of the instant flow through type could be used. As the hot water mixture passes towards the applicator 5, the pressure drops so that the mixture becomes foam, preferably at temperatures over 90 C.

The hand held applicator 5 and boom applicator 6 will be described in further detail but each provide an outlet for spraying the hot water mixture over weeds in the form of foam.

By delivering a volume of air (cold or hot) by way of a side channel blower directly into a chamber containing the hot foam mixture produced hot wet to dry foam that was applied directly onto the vegetation.

Trials proved that hot foam applied at application temperatures between 90 C-94 C increased term of kill by more than 50% over the equivalent use of hot water applied at 100 C.

Figures 2 to 4 show the preferred form hand held applicator 5. It comprises a shaft 8 and handle 9, and preferably a trigger 10 whereby the operator may turn the supply of hot foam on and off.

The applicator is connected to the flexible hose 7, which may for example pass down inside the interior of the handle 8 to a nozzle 11 as an outlet at the base of the shaft 8, as shown in Figure 4. The nozzle 11 acts to deliver the hot foam. A shroud 12 suitably shaped as shown is provided about the nozzle 11 to contain the hot foam about the area beneath the applicator being treated at any instant as the applicator is moved over the ground, and to prevent dissipation of the foam by wind for example. The shroud may suitably be formed of metal or plastics or any other suitable material. It is preferred but not essential to employ some form of shroud. In the applicator shown in the drawings the front and rear edges of the shroud are enlarged at 12a so that they can move easily over weed foliage. Any other suitable arrangement of shroud could be employed.

To maintain the nozzle 11 at a substantially constant spacing above the ground, the applicator comprises wheels 13. The wheels 13 are fixed to the shroud 12 or to some other frame at the base of the shaft 8 which also carries the shroud 12, and are so positioned that the nozzle 11 is positioned at the desired height above the ground. It has been found most desirable that the outlet is positioned at not more than 100 millimetres within the ground for most effective operation. The spacing depends on the volume flow rate and pressure of flow through the nozzle selected and by easy experimentation the optimum or effective height may be found. In the preferred form applicator head with a hot foam temperature of about 90-95 C and a water consumption/flow rate of 100 litres per hour, an outlet spacing from the ground of about 50 millimetres has been found to be most effective.

In use, an operator moves the applicator over the ground by rolling it along on the wheels 13, operating the trigger 10 to spray hot foam onto weeds over which he rolls the applicator. The wheels 13 ensure that the foam is applied to weeds from the constant height.

Alternatively to the wheels 13 a single wheel, or one or more skids could be employed, for example, various other configurations of manually, hand held applicator will be apparent from that described. It is also possible that to enhance penetration to the root system of the weeds, the applicator could include one or more wheels with spikes or tines, for example mounted within the shroud 12, to penetrate the soil surface.

Figure 5 shows the preferred form of towed boom applicator 6 from behind. The boom applicator comprises a frame 14 having a draw bar 14a (see Figure 1). The frame 14 forms a boom carrying a foam pipe 15 extending along the length of the boom as shown. The pipe 15 is connected to the hose 7 from the high-pressure pump via pipe 16. At either end of the

frame/boom are provided ground wheels 17, which maintain a constant spacing between the boom and the ground as the boom passes over the ground. A subsidiary wheel 18 may be provided as shown.

A number of foam outlets 19 are provided from the pipe 15, with one preferred arrangement being shown in Figure 6. Each outlet 19 comprises a short length of flexible hose 20 connected to the pipe and mounting a nozzle 21 at its lower end. In use hot foam passes through the pipe 15 down through the short flexible hose 20 and is ejected from the nozzle 21 over the ground over which the boom moves. The advantage of the flexible mounting arrangement is that each nozzle can deflect when hitting taller weeds or other obstructions. A shroud 22 formed of for example, rubber or plastic flaps or even a rigid shroud, may be provided on either side of the boom to shroud the foam outlets 19 along the boom and contain the foam for maximum effect.

Any other suitable shroud arrangement could however be employed. In Figure 5 the shroud is shown partly removed so that the outlets 19 along part of the boom can be seen.

One or both sides of the boom may be pivotally mounted. In Figure 5, one side of the boom is pivotally mounted at 23 so that it can pivot upwardly, as that side of the boom passes over a slope, or be pivoted upwardly by cylinder 24 to reduce the width of the boom applicator for towing when not in use, as is known for other types of agricultural equipment comprising a boom for applying herbicides or fertilisers, etc.

Again, it will be clearly apparent that a boom applicator for applying hot foam in accordance with the invention could be otherwise arranged. For example, the boom applicator could be mounted to the front of a tractor instead of being towed. The boom could form part of a purpose built vehicle. For example, a purpose built vehicle could instead of employing a boom have a number of spray outlets on its underside between wheels at four corners of the vehicle with shrouds about the sides of the vehicle towards the ground, to spray foam onto weeds as the vehicle is driven over them. Again in the case of a handheld applicator the water supply and water heater could be mounted to a frame to form a back pack unit, powered over a long extension cord from a mains supply or a mobile generator or battery.

ADVANTAGES

Using the equipment described above, we have found the following properties and advantages due to the use of the hot foamed water, rather than hot water alone.

Heat was kept on the vegetation for up to 10 minutes, allowing for greater application speeds.

Expanded hot foam covered an area up to 5 times greater than hot water for the same water output.

Hot foam could treat dense or high vegetation in a fraction of the time it would take to do the work with hot water, e. g. trials on an area of Bondi Beach in Australia took 8 hours with the hot foam. Previous hot water treatment had taken 24 hours.

Use of the hot foam proved successful on wire mesh fencelines and under obstacles (e. g. guard rails, etc) where hot water use was not commercially viable.

Trials proved there was a direct correlation between the retention time of heat (above 70°C) on the plant and the term of kill or control. This was relevant to all species tested. These included various grasses (rye, kikuyu, couch, barley, poa, paspalum) and various plantains (dock, buttercup, thistle, amaranthus, nightshade, vervain, fennel, hemlock, portulaca, etc).

Average control time with hot water is 6-8 weeks. Foam extends control to 8-12 weeks and some kikuyu trials in Auckland gave 16 weeks good control.

VARIATIONS

Plant sugar extracts were trialed successfully as the foam agent. Further trials are continuing to reduce the actual content of the plant sugars and replace with natural polymers. The foam agent is fully biodegradable both aerobically and anaerobically and can withstand heat of 100°C as well as being stable with organic compounds introduced to the water mixture.

If preferred, the air supply to the foam could be heated, but the improved result has to be offset against the extra complication and cost. Finally, various other alterations or modifications may be made to the foregoing without departing from the scope of this invention.

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